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Aerially Observed Defoliation by Western Spruce Budworm in 1982 and Predictions for Defoliation in 1983 - Boise/Payette National Forests and Adjacent Forest Land -

by
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ABSTRACT

Aerially observed defoliation of conifers by western spruce budworm in 1982 increased over 1981 levels in both extent and severity. A sequential egg-mass sampling system was used to evaluate potential for western spruce budworm in 1983 to defoliate hosts in three entomological units located in and adjacent to Boise and Payette National Forests. Pupae sampling was used to evaluate defoliation potential in three additional entomological units in the same general area. Defoliation in 1983 is expected to remain static or to intensify both in severity and extent in most units that were sampled.

INTRODUCTION

Western spruce budworm (WSB), Choristoneura occidentalis Freeman, has been active on the Boise and Payette National Forests and adjacent forested lands for the last decade (Knopf 1980; USDA Forest Service 1978, 1981). Western spruce budworm feeding has resulted in varying degrees of tree defoliation, top-kill, and mortality (USDA Forest Service 1978). During 1982 the infestation in this area was aerially surveyed to monitor extent and severity of defoliation, and two ground survey methods were used to obtain WSB population information with which to predict defoliation for 1983. Information from these surveys and 1983 damage projections are presented in this report.

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METHODS

Aerial surveys were conducted from low-flying aircraft during July and August. Defoliation was classified into three severity groups: heavy, moderate, and light.

Two survey methods were used to obtain insect population information with which to predict 1983 defoliation. One method involved sampling egg masses; the second involved sampling pupae cases (exuviae).

Egg-Mass Sampling

A sequential system was used to sample WSB egg masses. Methods used are similar to those identified by Williams et al. (1982) except that the sequential table (appendix) was revised. Revision was based on WSB data collected in the McCall area and involved a variable, WSB density dependent, value of the negative binomial parameter k.

Because of funding constraints, only the three high priority entomological units identified in 1981 (Williams et al. 1982) were intensively surveyed for egg-mass deposition. These were units 1, 4, and 5 (fig. 1). Sample point locations were the same as those in 1981 except in unit 4 where additional points were established in order to more effectively sample the unit. A total of 38, 46, and 44 points were sampled in units 1, 4, and 5 respectively. Locations are shown in fig. 1.

Pupae-Case Sampling

The second population sampling method involved counting pupae cases and was accomplished entirely in the field. At each sample point, defoliation was subjectively estimated for 12 randomly selected host (true fir, Douglas-fir) trees, and pupae cases were counted on a single 45 cm-long branch collected from the lower crown of each tree. Cumulative numbers of pupae cases counted at each point were classified as predicting heavy, moderate, or low defoliation levels for 1983 as follows: light, 2 or less; moderate, 4-11; and heavy, 14 plus. Class limits were based on pupae data previously collected in the McCall area and developed by Campbell[2].

Entomological units 6, 8, and 11 identified in 1981 (Williams et al. 1982) were sampled using the pupae case count method. These units were considered as second priority in 1981 or were observed to contain very large amounts of defoliation in 1982.

A total of 12, 10, and 11 points were sampled in units 6, 8, and 11 respectively. Sample point location was based on accessibility and presence of aerially observed defoliation. Specific sample point locations are not identified since population presence and only general defoliation predictions were desired.

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RESULTS

Aerial Survey

During the 1982 aerial detection survey, approximately 1,000,000 acres were identified as being infested by western spruce budworm (table 1). This is a substantial increase over 1981. Areas of defoliation are shown in figure 1.

Compared to 1981 defoliation levels, an expansion of 371,000 acres of defoliation occurred on the Boise National Forest. Much of this increase was attributed to an expansion of existing infestations into contiguous areas rather than to the emergence of new isolated infestations. The greatest infestation expansions were in the Douglas-fir and subalpine fir types located primarily on the Boise and Idaho City Ranger Districts. Hosts in the West Mountain area on the Cascade Ranger District continued to be very heavily defoliated with occasional understory mortality and top-kill being apparent in subalpine/white fir stands.

In 1982, most defoliation on the Boise National Forest was classified as being moderate to heavy, whereas in 1981, most defoliation was classified as being light (table 1).

Defoliation on the Payette National Forest increased over 1981 acreages by 65,000 acres, primarily in the Douglas-fir type. Although most of this increase can be attributed to expansion of existing infestations, several new areas of defoliation were observed over approximately 9,000 acres of Douglas-fir on the Weiser Ranger District. In contrast to the light defoliation intensity noted in 1981, most defoliation on the Forest in 1982 was categorized as being moderate to heavy.

Table 1. Areas visibly defoliated by western spruce budworm on the Boise and Payette National Forests during 1981 and 1982 as determined from aerial detection surveys

Forest (and adjacent land)	Year	Defoliation Intensity: Light	Moderate	Heavy	Total	Trend
Boise	1982	140,902	361,643	171,936	674,481	+371,197
	1981	165,062	104,091	34,131	303,284	--
Payette	1982	68,640	158,586	138,154	365,380	+ 64,909
	1981	164,837	71,553	64,081	300,471	--
Total	1982	209,542	520,229	310,090	1,039,861	+436,106
	1981	329,899	175,644	98,212	603,755	--

Egg Mass Evaluations

Egg-mass-based defoliation predictions for 1983 have been categorized as being light, moderate, or heavy and are shown for specific individual sample points in figure 1. Barring climatic-related population influences, the following defoliation levels, based on egg-mass populations, are expected in 1983.

Unit 1 - Defoliation should expand into new areas and intensify in the Boulder-Mud Creek areas. Increased defoliation should be observed in the Bally-Granite area and Sixmile Creek drainage. Forested areas south of New Meadows in the Little Salmon and Big Creek drainages will show increased defoliation intensity in 1983.

Unit 4 - In general, defoliation in the Little Weiser River and the Middle and East Forks of the Weiser River drainages will remain fairly heavy. The defoliation should be moderate on the Hornet and Johnston Creek area west of Council. It appears that defoliation will be static to decreasing for the Boise National Forest portion of this unit (light-moderate).

Unit 5 - The McCall-Lake Fork area will remain about the same as 1982 with small areas increasing and others decreasing in defoliation. The West Mountain area and the west side of Cascade Reservoir will decrease to moderate defoliation. Most areas sprayed in 1979 will increase to moderate or heavy defoliation with a very heavy area in Gold Fork Creek.

Pupae Evaluations

Pupae sampling was found to be two-thirds less expensive, resulting largely from significantly reduced manpower requirements than the more commonly used egg-mass surveys. Using the pupae case sampling system, presence of WSB was confirmed and, barring environmental influences, general 1983 defoliation predictions are unit 6, light to heavy; units 10 and 11, moderate to heavy.

DISCUSSION

The WSB infestation on and adjacent to the Boise and Payette National Forests increased in size and, in some cases, severity during 1982. In 1983, defoliation will likely expand into new areas, and severity will likely remain static or increase except in the chronically defoliated West Mountain, Brundage Mountain, and Sagehen Reservoir areas. Defoliation severity will likely decrease in these areas.

Defoliation predictions based on 1981 egg-mass data (Williams et al. 1982) were compared with defoliation by WSB observed during 1982 aerial-detection surveys. In the majority of cases, defoliation severity was accurately predicted. Additionally, 1982 aerial surveys confirmed most predicted expansions into adjacent areas and isolated new occurrences of WSB activity. Based on the above-noted confirmations of predicted defoliation for

1982, sequential egg-mass sampling systems do indeed seem worthy of further consideration, especially where direct suppression alternatives are considered for managing WSB.

As suggested earlier (Williams et al. 1982), quick, inexpensive reconnaissance surveys, to confirm presence of WSB populations in areas with aerially observed defoliation, were used to generally classify defoliation over entire entomological units 6, 8, and 11. Verification of these general trends will be made using data from 1983 aerial detection surveys. Such a system, while providing data perhaps less reliable than that obtained from egg-mass surveys, may provide adequate information to land managers. Additionally, it offers the advantages of reducing costs per sample point up to 65 percent by (1) eliminating the need for expensive laboratory operations and (2) enabling the combining of WSB sampling with ground evaluations of aerial survey information and observing pest problems not detected by aerial surveyors.

MANAGEMENT ALTERNATIVES

Maintain Present Management. No action will be taken with this approach. The infestation will be allowed to continue, likely for 7-10 years, until natural abatement occurs. Short-term resource impacts including growth loss, top-kill, some understory mortality, and reduced seed production will be accepted. Generally, impacts should be minimal in mixed species stands.

Direct Suppression. One or more available registered insecticides, Carbaryl, Acephate, Malathion, or Bacillus thuringiensis (microbial insecticide), will be applied either to the entire infestation or to a portion thereof. Approximate costs would be $10 to $15 per acre. Short-term impacts to the various resources would be reduced significantly for a 3- to 4-year period, after which the population likely would return to prespray levels. Because treatment would preserve the food base, a chronic infestation could develop, particularly if suppression is undertaken whenever the population resurges to damaging levels.

Silvicultural Management. Stands susceptible to WSB activity will be managed to reduce potential for damage. Such treatments include (1) striving for species diversity favoring seral species, (2) maintaining or improving vigor of a stand by conducting timely thinnings and selecting against trees affected with other damage agents including dwarf mistletoe and root/stem decays, (3) harvesting susceptible stands at maturity using even-aged regeneration systems, and (4) creating a mosaic of stands of differing ages. This long-term approach is aimed at reducing the impact of future outbreaks. During the current infestation, such management will be of benefit to only those stands treated.

RECOMMENDATIONS

An integrated approach is recommended to deal with current and future WSB infestations. Since sound silviculture is also good pest management, silvicultural management is recommended as a base program. Stands with highest value and impact should be treated first. Perhaps WSB impact in these stands could even be reduced during the current infestation.

Direct suppression may be considered in high-value young stands, recreation, and seed production areas. This type of protection would have very short-term action due to insect populations resurging in contiguous areas.

REFERENCES

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APPENDIX

Sequential Sampling Scheme for Egg-Mass Populations on Midcrown 45-cm Terminal Tips

	95-Percent Confidence Level			
No. of trees	Light	Moderate	Moderate	Heavy
10	3	5	9	10
14	4	6	13	15
15	5	7	14	16
20	6	10	19	21
25	8	12	24	26
50	16	24	48	52
60	19	29	58	63
70	23	34	67	74
80	26	39	77	84
90	29	43	87	95
100	32	48	97	105

WESTERN SPRUCE BUDWORM DEFOLIATION

1982

1 3 9 4 6 7 5 11 10 8 2

DEFOLIATION INTENSITY

- LIGHT
- MODERATE
- HEAVY

ENTOMOLOGICAL UNITS

1983 PREDICTED DEFOLIATION INTENSITY – UNITS 1,4,5

- • LIGHT
- * MODERATE
- * HEAVY

1982